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[NAME OF THE DOCUMENT] Drawings 1

[NAME OF THE DOCUMENT] Abstract 1

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[NAME OF THE DOCUMENT] Specification

[TITLE OF THE INVENTION] ALERT RELATING TO REMAINING FUEL AMOUNT OF FUEL CELL SYSTEM

[CLAIMS]

[CLAIM 1]

A method of notifying a user of fuel-related information of a fuel cell system, characterized in that

information related to a remaining fuel amount is communicated to the user when fuel of the fuel cell system is consumed in a state where a switch for switching between operation and stop states of the fuel cell system is switched to a stop side.

[CLAIM 2]

The method according to claim 1, wherein

the communication of the information related to the remaining fuel amount includes at least generating an alert for the user when the fuel of the fuel cell system is consumed and the remaining fuel amount falls to an alert generating level.

[CLAIM 3]

The method according to claim 2, wherein

the generation of the alert is implemented when fuel is consumed due to the fuel cell system performing a heat-retention operation.

[CLAIM 4]

The method according to claim 2 or 3, wherein

the alert is sent to an information terminal of the user using wireless communication.

[CLAIM 5]

The method according to any one of claims 2 to 4, wherein

the fuel cell system is mounted in a movable body, and

the alert includes information related to at least one of a remaining fuel amount, a possible heat-retention operation time of the fuel cell system, a possible running distance of the movable body, and a distance to a nearest fuel station.

[CLAIM 6]

The method according to claim 5, wherein

the alert generating level is set such that the possible running distance of the movable body includes a margin with respect to the distance to the nearest fuel station.

[CLAIM 7]

A method of notifying a user of fuel-related information of a fuel cell system mounted in a movable body, characterized in that

information related to a remaining fuel amount is communicated to an information terminal of the user at a location away from the movable body using wireless communication when fuel of the fuel cell system is consumed in a state where a switch for starting the movable body is switched to a stop side.

[CLAIM 8]

The method according to claim 7, wherein

the communication is conducted at predetermined time intervals.

[CLAIM 9]

The method according to claim 7, wherein

the communication is conducted when the remaining fuel amount falls to an alert generating level.

[CLAIM 10]

A fuel cell system, characterized by comprising:

a switch which switches between operation and stop states of the fuel cell system;

a fuel storage unit which stores fuel supplied to the fuel cell system;

a remaining amount measuring unit which measures a remaining fuel amount in the fuel storage unit; and

a communication unit which communicates information related to a remaining fuel amount to a user when fuel in the fuel storage unit is consumed in a state where the switch is switched to a stop side.

[CLAIM 11]

The fuel cell system according to claim 10, wherein

the communication of information related to the remaining fuel amount includes at least generating an alert for the user when fuel in the fuel storage unit is consumed and the remaining fuel amount falls to an alert generating level.

[CLAIM 12]

The fuel cell system according to claim 11, wherein

the generation of the alert is implemented when fuel is consumed due to the fuel cell system performing a heat-retention operation.

[CLAIM 13]

A fuel cell system mounted in a movable body, characterized by comprising:

a switch which switches between operation and stop states of the fuel cell system;

a fuel storage unit which stores fuel supplied to the fuel cell system;

a remaining amount measuring unit which measures a remaining fuel amount in the fuel storage unit; and

a communication unit which sends information related to the remaining fuel amount to an information terminal of a user at a location away from the movable body using wireless communication when fuel in the fuel storage unit is consumed in a state where the switch is switched to a stop side.

[CLAIM 14]

A movable body in which the fuel cell system according to any one of claims 11 to 13 is mounted, wherein

the switch is a switch for starting the movable body.

[DETAILED DESCRIPTION OF THE INVENTION]

[0001]

[TECHNICAL FIELD]

The invention relates to an art for alerting or notifying a user of information related to a remaining fuel amount of a fuel cell system.

[0002]

[RELATED ART]

If the outside temperature falls to 0°C or below when a fuel cell system is stopped, water inside the fuel cell system freezes, which may cause a trouble in operation thereafter. Therefore, an art for preventing freezing of the fuel cell system has been proposed (for example, see Patent Document 1 and Patent Document 2). In the art described in Patent Document 1, when the outside temperature falls below an antifreeze temperature, the fuel cell system automatically initiates a heat-retention operation.

[0003]

[Patent Document 1]

Japanese Patent Application Publication No. JP-A-2002-231108

[Patent Document 2]

Japanese Patent Application Publication No. JP-A-7-169476

[0004]

[PROBLEM TO BE SOLVED BY THE INVENTION]

However, if the heat-retention operation is conducted for a long period of time, fuel for the fuel cell system is consumed, and there is a possibility of insufficient fuel during operation thereafter. Such a problem is not limited to a case where the heat-retention operation is conducted for preventing freezing, but rather it is a problem that can occur when the fuel cell system is continuously operated due to any cause.

[0005]

The invention has been made to solve the above-described problem in the related art. It is an object of the invention to provide an art capable of preventing a problem caused by excessive lowering of the remaining fuel amount of a fuel cell system.

[0006]

[MEANS FOR SOLVING THE PROBLEM AND OPERATION/EFFECT THEREOF]

In order to achieve at least a portion of the above-described object, a first method of the invention is a method of notifying a user of fuel-related information of a fuel cell system. The method is characterized in that information related to a remaining fuel amount is communicated to the user when fuel of the fuel cell system is consumed in a state where a switch for switching between operation and stop states of the fuel cell system is switched to a stop side.

[0007]

According to this method, information related to the remaining fuel amount is communicated to the user when fuel is consumed by the fuel cell system while in a practically stopped state. Therefore, it is possible to prevent excessive lowering of the remaining fuel amount of the fuel cell system.

[0008]

Note that the communication of the information related to the remaining fuel amount may include at least generating an alert for the user when the fuel of the

fuel cell system is consumed and the remaining fuel amount falls to an alert generating level.

[0009]

According to this method, the alert is generated for the user when the remaining fuel amount falls to the alert generating level as a result of consumption of the fuel in the fuel cell system. Therefore, at that time, the user can know that the remaining fuel amount is small.

[0010]

It is preferable that the generation of the alert is implemented when fuel is consumed due to the fuel cell system performing a heat-retention operation.

[0011]

According to this method, when the fuel is consumed due to continuation of the heat-retention operation, excessive lowering of the remaining fuel amount can be prevented.

[0012]

It is preferable that the alert is sent to an information terminal of the user using wireless communication.

[0013]

According to this method, even when the user is at a location away from the fuel cell system, it is possible to send the alert.

[0014]

The fuel cell system may be mounted in a movable body, and the alert may include information related to at least one of a remaining fuel amount, a possible heat-retention operation time of the fuel cell system, a possible running distance of the movable body, and a distance to a nearest fuel station.

[0015]

With this configuration, the user can easily take appropriate action in accordance with the information included in the alert.

[0016]

It is preferable that the alert generating level is set such that the possible running distance of the movable body includes a margin with respect to the distance to the nearest fuel station.

[0017]

According to this method, it is possible to move the movable body to the nearest fuel station after receiving the alert.

[0018]

A second method of the invention is a method of notifying a user of fuel-related information of a fuel cell system mounted in a movable body. The method is characterized in that information related to a remaining fuel amount is communicated to an information terminal of the user at a location away from the movable body using wireless communication when fuel of the fuel cell system is consumed in a state where a switch for starting the movable body is switched to a stop side.

[0019]

According to this method, the information related to the remaining fuel amount is communicated to the user. Thus, it is possible to prevent excessive lowering of the remaining fuel amount of the fuel cell system.

[0020]

The communication may be conducted at predetermined time intervals. Alternatively, the communication may be conducted when the remaining fuel amount falls to an alert generating level.

[0021]

If the communication is conducted at predetermined time intervals, the user can know the information related to the remaining fuel amount periodically. On the other hand, if the communication is conducted when the remaining fuel amount falls to the alert generating level, it is possible to notify the user of the remaining fuel amount before excessive lowering of the remaining fuel amount of the fuel cell system.

[0022]

A first fuel cell system of the invention is characterized by including: a switch which switches between operation and stop states of the fuel cell system; a fuel storage unit which stores fuel supplied to the fuel cell system; a remaining amount measuring unit which measures a remaining fuel amount in the fuel storage unit; and a communication unit which communicates information related to a remaining fuel amount to a user when fuel in the fuel storage unit is consumed in a state where the switch is switched to a stop side.

[0023]

A second fuel cell system of the invention is a fuel cell system mounted in a movable body, which is characterized by including: a switch which switches between operation and stop states of the fuel cell system; a fuel storage unit which stores fuel supplied to the fuel cell system; a remaining amount measuring unit which measures a remaining fuel amount in the fuel storage unit; and a communication unit which sends information related to the remaining fuel amount to an information terminal of a user at a location away from the movable body using wireless communication when fuel in the fuel storage unit is consumed in a state where the switch is switched to a stop side.

[0024]

A movable body of the invention is a movable body in which any one of the above-described fuel cell systems is mounted, and which is characterized in that the switch is a switch for starting the movable body.

[0025]

It should be noted that the invention can be realized in various forms. For example, the invention can be realized in the form of: a fuel cell system and an alert method and a control method thereof; a movable body provided with a fuel cell system and a control method thereof; a computer program for realizing these methods or the function of the system; a storage medium in which the computer program is stored; and a data signal embodied in a carrier wave that includes the computer program.

[0026]

[EMBODIMENTS OF THE INVENTION]

Next, exemplary embodiments of the invention will be described in the following order.

A. System structure:

B. Operations in respective embodiments:

C. Modifications:

[0027]

A. System structure:

FIG. 1 is a schematic structural drawing of an electric vehicle communication system according to an embodiment of the invention. The system includes an electric vehicle (also simply referred to as "vehicle") 100, a communication satellite 200 and a cellular phone base station 300 for wireless

communication, and an information terminal 400 carried by a user. The electric vehicle 100 has a fuel cell system 10 as a main power source, and includes a communication unit 20 for performing wireless communication. The communication unit 20 is capable of functioning as an alert generating portion that forwards alerts relating to the remaining fuel amount and information relating to the remaining fuel amount (for example, the amount of remaining hydrogen, possible running distance) to the information terminal 400 via the communication satellite 200 or the cellular phone base station 300.

[0028]

It is possible for the user to use a cellular phone, a house phone, a personal computer, a so-called PDA (portable digital assistant) or the like as the information terminal 400. In addition, a key holder of a key for the electric vehicle 100, or the key itself to which information receiving function and information display function are added may be used as the information terminal 400.

[0029]

Note that, for the forwarding of information to the information terminal 400 from the communication unit 20 of the electric vehicle 100, wireless communication is not necessarily used for the entire route, and wireless communication may be used for only a portion of the route. In the specification, the phrase "using wireless communication" means that wireless communication is used for at least one portion of the route.

[0030]

FIG. 2 is a block diagram showing a main electric structure of the electric vehicle 100. The entire electric vehicle 100 is controlled by a control unit 30. The fuel cell system 10 has a fuel cell control unit 12 (hereinafter referred to as "FC control unit 12"), a fuel cell stack 14, a high-pressure hydrogen tank 16 serving as a fuel storage unit, and a pressure sensor 18 serving as a remaining amount measuring unit. Note that several structure elements of the fuel cell system 10 (air compressor, various valves etc.) are omitted in the figure.

[0031]

The electric vehicle 100 has a secondary battery 40 serving as an auxiliary power source, in addition to the fuel cell system 10 serving as the main power source. The secondary battery 40 is connected in parallel with the fuel cell stack 14 via a DC/DC converter 42. A three-phase inverter circuit 50 creates a three-phase AC

power source from these DC power sources, which is supplied to a motor 52 for driving a wheel, and controls the rotational speed and torque of the motor 52.

[0032]

The control unit 30 receives various signals from various sensors. For example, a signal indicating the remaining fuel amount (specifically, pressure) is received from the pressure sensor 18 of the high-pressure hydrogen tank 16, and a signal indicating a remaining capacity SOC is received from the secondary battery 40. Furthermore, the control unit 30 is connected to a navigation system 60 for displaying the travel route of the vehicle and the like.

[0033]

When a key 32 (ignition key) of the electric vehicle 100 is operated to an ON state, respective portions including the control unit 30 are activated to create a state allowing operation of the electric vehicle 100 by the user. On the other hand, when the key 32 is set to an OFF state, the control unit 30 stops the operation of each portion. However, the FC control unit 12 implements a heat-retention operation of the fuel cell system 10 if necessary when the outside temperature falls to a freezing temperature (for example, 0°C) or below. By generating electric power using the fuel cell stack 14, the heat-retention operation works to prevent the freezing of water in the fuel cell stack 14 and other portions. Consequently, during the heat-retention operation, hydrogen within the hydrogen tank 16 is gradually consumed, thus lowering the remaining amount of the hydrogen. Note that the electric power generated by power generation is used as power for auxiliary machinery such as an air compressor, and as power for an electric heater. However, when surplus electric power is generated, it is used for charging the secondary battery 40. Hereinafter, the description will be made focusing on various processing sequences when such a heat-retention operation is conducted that lowers the remaining hydrogen amount.

[0034]

B. Operations in respective embodiments:

B-1. First embodiment:

FIG. 3 is a flowchart showing a processing sequence according to a first embodiment. The processing sequence is implemented under the control of the control unit 30. However, it may be implemented under the control of the FC control unit 12, instead of the control unit 30. This also holds true in other embodiments to be described later.

[0035]

After the user turns off the key 32 to stop the operation of the entire vehicle (step S1), if the outside temperature falls to a freezing temperature or below, the heat-retention operation of the fuel cell system 10 is initiated (step S2). During the heat-retention operation, the control unit 30 determines whether the remaining hydrogen amount in the hydrogen tank 16 has reached a predetermined alert value (also referred to as "alert generating level") (step S3). Specifically, for example, it is determined whether a tank pressure P measured with the pressure sensor 18 is a preset alert value or less. Instead of this, a tank weight or the like may be measured to determine the remaining hydrogen amount. If the remaining hydrogen amount is the alert value or less, the communication unit 20 sends an alert indicating that the remaining hydrogen amount has reached the alert value to the information terminal 400 (FIG. 1) of the user (step S4). The information terminal 400 notifies the user of the alert using a screen display and/or sound. Note that the control unit 30 and the communication unit 20 are capable of operating in order to communicate such alerts, if necessary, even when the operation of the vehicle is stopped.

[0036]

Alerts communicated by the information terminal 400 may include a portion or all of the following various information, in addition to the remaining hydrogen amount reaching the alert value.

(1) Current remaining hydrogen amount

(2) Possible heat-retention operation time (estimated time until hydrogen is gone)

(3) Possible running distance

(4) Outside temperature

(5) Vehicle location information

(6) Location information (location, distance and the like) of nearest fuel station (hydrogen station)

(7) Route information to nearest fuel station

[0037]

The information of the above (3) (possible running distance) may be calculated in accordance with the remaining hydrogen amount, or calculated based on both the remaining hydrogen amount and the remaining capacity of the secondary battery 40. The information of the above (5) to (7) can be obtained by using a GPS terminal function of the navigation system 60. Note that these pieces of information

may be sent from the communication unit 20 to the information terminal 400 in response to a user request.

[0038]

However, an alert sent to the user preferably includes information related to at least one of the remaining fuel amount, the possible heat-retention operation time of the fuel cell system 10, the possible running distance of the vehicle, and the distance to the nearest fuel station. If designed as such, it has the advantage of allowing the user to easily devise appropriate actions in response to the alert.

[0039]

Thus, in the first embodiment, when the key 32 of the vehicle is set to the OFF state, if the fuel cell system 10 conducts the heat-retention operation and the remaining hydrogen amount reaches the alert value, an alert is sent to a remote user. As a result, it is possible to prevent the remaining hydrogen amount from becoming excessively low without the user's knowledge.

[0040]

B-2. Second embodiment:

FIG. 4 is a flowchart showing a processing sequence according to a second embodiment. Step S11 (vehicle is stopped) and step S12 (initiate heat-retention operation) are identical to steps S1 and S2 in FIG. 3. After initiating the heat-retention operation, the control unit 30 determines whether the remaining hydrogen amount has reached a first alert value P1 (step S13). If the remaining hydrogen amount has reached the first alert value P1, the communication unit 20 sends a type 1 alert to the information terminal 400 of the user (step S14). Thereafter, the control unit 30 continuously monitors the remaining hydrogen amount, and determines whether the remaining hydrogen amount has reached a second alert value P2 (P2<P1) (step S15). If the remaining hydrogen amount has reached the second alert value P2, the communication unit 20 sends a type 2 alert to the information terminal 400 of the user (step S16).

[0041]

Note that it is possible to set the first and second alert values P1 and P2 to arbitrary values. It is preferable that the alert values P1 and P2 are capable of being arbitrarily changed by the user. In addition, three or more values may be set as alert values.

[0042]

Thus, in the second embodiment, a plurality of alert values is set in advance, and an alert is issued every time the remaining hydrogen amount reaches each of the alert values. Therefore, in the case where the user cannot take action for the first alert, action can be taken for any one of a plurality of alerts. Consequently, it is possible to reliably prevent the remaining hydrogen amount from becoming excessively low.

[0043]

B-3. Third embodiment:

FIG. 5 is a flowchart showing a processing sequence according to a third embodiment. Step S21 (vehicle is stopped) and step S22 (initiate heat-retention operation) are identical to steps S1 and S2 in FIG. 3. After initiating the heat-retention operation, the control unit 30 determines whether the remaining hydrogen amount has reached the alert value every time a predetermined time passes (steps S23 and S24). If the remaining hydrogen amount has reached the alert value, the communication unit 20 sends an alert (step S25). On the other hand, if the remaining hydrogen amount has not reached the alert value, the process shifts to the following processing in step S26.

[0044]

In step S26, the control unit 30 determines whether or not information related to the remaining hydrogen amount (also referred to as "fuel-related information") has been preset by the user to be periodically sent to the information terminal 400. If set, the communication unit 20 sends the fuel-related information to the information terminal 400 (step S27). On the other hand, if not set, the process returns to step S23. Note that the fuel-related information sent preferably includes at least one portion of information (1) to (7) described in the first embodiment.

[0045]

Thus, in the third embodiment, fuel-related information is sent to the information terminal 400 at predetermined time intervals (i.e., at a predetermined cycle). Therefore, it is possible to obtain information related to the remaining hydrogen amount before the remaining hydrogen amount reaches the alert value. In addition, an alert is sent when the remaining hydrogen amount reaches the alert value, so that it is possible to prevent the remaining hydrogen amount from becoming excessively low without the user's knowledge.

[0046]

Note that in the sequence in FIG. 5, the cycle for sending the fuel-related information and the cycle for determining whether the remaining hydrogen amount has reached the alert value are identical to each other. However, these two cycles may be respectively set to different arbitrary values by the user. For example, the cycle for determining whether the remaining hydrogen amount has reached the alert value can be set shorter than the cycle for sending the fuel-related information. In this case, when the remaining hydrogen amount has reached the alert value, it is possible to send the alert with a little time delay. Alternatively, when the remaining hydrogen amount has reached the alert value, the alert may be immediately sent without waiting for a predetermined time to pass.

[0047]

B-4. Fourth embodiment:

FIG. 6 is a flowchart showing a processing sequence according to a fourth embodiment. Step S31 (vehicle is stopped) and step S32 (initiate heat-retention operation) are identical to steps S1 and S2 in FIG. 3. When the heat-retention operation is initiated, the control unit 30 obtains the current location of the vehicle and the location of the nearest fuel station (hydrogen station) from the navigation system 60 (step S33).

[0048]

In step S34, the control unit 30 calculates the alert value of the remaining hydrogen amount based on the current location of the vehicle and the location of the nearest fuel station. The alert value is set such that the possible running distance of the vehicle when the remaining hydrogen amount reaches the alert value includes a predetermined margin with respect to the distance to the nearest fuel station (the required moving distance). More specifically, for example, the alert value is set such that the possible running distance of the vehicle is a value including a 10% margin over the required moving distance.

[0049]

The control unit 30 determines whether the remaining hydrogen amount has reached the alert value (step S35), and when the alert value is reached, the communication unit 20 sends an alert to the information terminal 400 (step S36).

[0050]

Thereafter, when the user returns to the vehicle and starts the vehicle by turning the key 32 to the ON state (step S37), the shortest route to the nearest fuel

station is automatically displayed on the screen of the navigation system 60 (step S38). Accordingly, the user can move the vehicle to the nearest fuel station in a short time in accordance with the display. Note that either the "shortest-time route" or the "shortest-distance route" may be displayed as the "shortest route".

[0051]

Thus, in the fourth embodiment, if the user returns to the vehicle and turns the key ON after an alert of the remaining hydrogen amount is generated, the shortest route to the fuel station is displayed on the navigation screen. Therefore, the user can reach the fuel station in a short time.

[0052]

C. Modifications:

Note that the invention is not limited to the above-described embodiments, and can be implemented in various forms, without departing from the spirit and scope of the invention. For example, modifications such as the following are possible.

[0053]

C1. First modification:

In each of the above-described embodiments, information is spontaneously sent from the vehicle to the information terminal 400 of the user. Instead of this, fuel-related information may be sent from the vehicle when the user sends a request from the information terminal 400. In this case, even if the user is away from the vehicle, it is possible to obtain fuel-related information at any time the user wants.

[0054]

C2. Second modification:

In the above-described embodiments, the high-pressure hydrogen tank 16 is used as a fuel storage unit. Instead of this, a liquid hydrogen tank, a solid metal hydride or the like may be used as a fuel storage unit. In addition, instead of storing hydrogen gas, fuel for reforming (alcohol such as methanol, and hydrocarbon compounds such as gasoline, aldehyde, and ether) may be stored in the fuel storage unit to generate hydrogen by conducting reforming in a reforming unit, which is supplied to the fuel cell stack.

[0055]

C3. Third modification:

In the above-described embodiments, the electric vehicle using the fuel cell system has been described as an example. However, the invention is applicable to movable bodies other than automobiles, such as ships and trains. In addition, the invention is also applicable to stationary fuel cell systems.

[0056]

C4. Fourth modification:

In the above-described embodiments, the key of the vehicle is used to switch between the operation and stop states of the fuel cell system. However, the switch for switching between the operation and stop states of the fuel cell system may also take a form of an arbitrary switch other than the key of the vehicle. For example, in the case of a stationary fuel cell system, a switch for manually switching between the operation and stop of the fuel cell system itself is normally provided.

[0057]

C5. Fifth modification:

The above-described embodiments describe the case where the fuel cell system performs the heat-retention operation. However, the invention is also applicable to a case where fuel is consumed due to some cause when the fuel cell system is stopped by the user. For example, there is a case where the operation of the fuel cell system 10 is continued to continue charging of the secondary battery 40 when the remaining capacity SOC of the secondary battery 40 is lowered when the key is OFF (when the ignition switch is OFF). The invention is also applicable to such a case. Namely, the invention is applicable to cases in which fuel of the fuel cell system is consumed in a state where the switch for switching between the operation and stop states of the fuel cell system is switched to the stop side.

[BRIEF DESCRIPTION OF THE DRAWINGS]

[FIG. 1]

FIG. 1 is a schematic structural drawing of an electric vehicle communication system according to an embodiment of the invention.

[FIG. 2]

FIG. 2 is a block diagram showing a main electric structure of an electric vehicle 100.

[FIG. 3]

FIG. 3 is a flowchart showing a processing sequence according to a first embodiment.

[FIG. 4]

FIG. 4 is a flowchart showing a processing sequence according to a second embodiment.

[FIG. 5]

FIG. 5 is a flowchart showing a processing sequence according to a third embodiment.

[FIG. 6]

FIG. 6 is a flowchart showing a processing sequence according to a fourth embodiment.

[DESCRIPTION OF THE REFERENCE NUMERALS]

10... FUEL CELL SYSTEM
12... FUEL CELL CONTROL UNIT (FC CONTROL UNIT)
14... FUEL CELL STACK
16... HIGH-PRESSURE HYDROGEN TANK
18... PRESSURE SENSOR
20... COMMUNICATION UNIT
30... CONTROL UNIT
32... KEY
40... SECONDARY BATTERY
42... DC/DC CONVERTER
50... THREE-PHASE INVERTER CIRCUIT
52... MOTOR
60... NAVIGATION SYSTEM
100... ELECTRIC VEHICLE
200... COMMUNICATION SATELLITE
300... CELLULAR PHONE BASE STATION
400... INFORMATION TERMINAL

[NAME OF THE DOCUMENT] Abstract of the disclosure

[ABSTRACT]

[TASK] To prevent a problem caused by excessive lowering of the remaining fuel amount of a fuel cell system.

[MEANS OF SOLVING THE PROBLEM] If the remaining fuel amount is lowered to an alert generating level when fuel of a fuel cell system 10 is consumed in a state where a switch for switching between operation and stop states of the fuel cell system 10 is switched to the stop side, a communication unit 20 sends an alert to an information terminal 400 of a user. The communication unit 20 may send fuel-related information other than an alert, to the information terminal 100 of the user.

[SELECTED DRAWING] FIG. 1

[NAME OF THE DOCUMENT] Drawings

[FIG. 1]

ALERT/ FUEL-RELATED INFORMATION

- REMAINING HYDROGEN AMOUNT
- POSSIBLE RUNNING DISTANCE

[FIG. 2]

12/ FC CONTROL UNIT

20/ COMMUNICATION UNIT

30/ CONTROL UNIT

40/ SECONDARY BATTERY

42/ DC/DC CONVERTER

50/ INVERTER

60/ NAVIGATION SYSTEM

1/ REMAINING FUEL AMOUNT

2/ REMAINING CAPACITY SOC

[FIG. 3]

1/ FIRST EMBODIMENT

S1/ VEHICLE IS STOPPED

S2/ INITIATE HEAT-RETENTION OPERATION OF FUEL CELL SYSTEM

S3/ HAS REMAINING HYDROGEN AMOUNT REACHED ALERT VALUE?

S4/ SEND ALERT

2/ END

3/ ISSUE ALERT WHEN TANK PRESSURE P IS EQUAL TO OR LOWER THAN ALERT VALUE

[FIG. 4]

1/ SECOND EMBODIMENT

S11/ VEHICLE IS STOPPED

S12/ INITIATE HEAT-RETENTION OPERATION OF FUEL CELL SYSTEM

S13/ IS REMAINING HYDROGEN AMOUNT EQUAL TO OR LOWER THAN FIRST ALERT VALUE?

S14/ SEND TYPE 1 ALERT

S15/ IS REMAINING HYDROGEN AMOUNT EQUAL TO OR LOWER THAN SECOND ALERT VALUE?

S16/ SEND TYPE 2 ALERT

2/ END

3/ SEND TYPE 1 ALERT WHEN TANK PRESSURE P IS EQUAL TO OR LOWER THAN ALERT VALUE P1

4/ SEND TYPE 2 ALERT WHEN TANK PRESSURE P IS EQUAL TO OR LOWER THAN ALERT VALUE P2 (P2<P1)

[FIG. 5]

THIRD EMBODIMENT

S21/ VEHICLE IS STOPPED

S22/ INITIATE HEAT-RETENTION OPERATION OF FUEL CELL SYSTEM

S23/ HAS PREDETERMINED TIME PASSED?

S24/ HAS REMAINING HYDROGEN AMOUNT REACHED ALERT VALUE?

S25/ SEND ALERT

S26/ HAS PERIODICAL INFORMATION SENDING BEEN SET?

S27/ SEND FUEL-RELATED INFORMATION

[FIG. 6]

FOURTH EMBODIMENT

S31/ VEHICLE IS STOPPED

S32/ INITIATE HEAT-RETENTION OPERATION OF FUEL CELL SYSTEM

S33/ OBTAIN CURRENT LOCATION OF VEHICLE AND LOCATION OF NEAREST FUEL STATION

S34/ CALCULATE ALERT VALUE OF REMAINING HYDROGEN AMOUNT

S35/ HAS REMAINING HYDROGEN AMOUNT REACHED ALERT VALUE?

S36/ SEND ALERT

S37/ VEHICLE IS ACTIVATED

S38/ DISPLAY SHORTEST ROUT TO FUEL STATION ON NAVIGATION SCREEN

END